ClinicalEvidence

Retinal detachment

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ABSTRACT

INTRODUCTION: Rhegmatogenous retinal detachment (RRD) is the most common form of retinal detachment, where a retinal "break" allows the ingress of fluid from the vitreous cavity to the subretinal space, resulting in retinal separation. It occurs in about 1 in 10,000 people a year. METHODS AND OUTCOMES: We conducted a systematic review and aimed to answer the following clinical questions: What are the effects of interventions to prevent progression from retinal breaks or lattice degeneration to retinal detachment? What are the effects of different surgical interventions in people with rhegmatogenous retinal detachment? What are the effects of interventions to treat proliferative vitreoretinopathy occurring as a complication of retinal detachment or previous treatment for retinal detachment? We searched: Medline, Embase, The Cochrane Library, and other important databases up to June 2010 (Clinical Evidence reviews are updated periodically; please check our website for the most up-to-date version of this review). We included harms alerts from relevant organisations such as the US Food and Drug Administration (FDA) and the UK Medicines and Healthcare products Regulatory Agency (MHRA). RESULTS: We found 21 systematic reviews, RCTs, or observational studies that met our inclusion criteria. We performed a GRADE evaluation of the quality of evidence for interventions. CONCLUSIONS: In this systematic review, we present information relating to the effectiveness and safety of the following interventions: corticosteroids, cryotherapy, daunorubicin, fluorouracil plus low molecular weight heparin, laser photocoagulation, pneumatic retinopexy, scleral buckling, short-acting or long-acting gas tamponade, silicone oil tamponade, and vitrectomy.

QUESTIONS

INTERVENTIONS

PREVENTING RETINAL DETACHMENT

Likely to be beneficial

DIFFERENT SURGICAL INTERVENTIONS FOR RHEGMATOGENOUS RETINAL DETACHMENT

Unknown effectiveness

TREATING RRD ASSOCIATED WITH PROLIFERATIVE VITREORETINOPATHY

Likely to be beneficial

Unknown effectiveness

To be covered in future updates

Preventing proliferative vitreoretinopathy

Footnote

*Based on consensus; no RCT evidence available.

Key points

- Rhegmatogenous retinal detachment (RRD) is the most common form of retinal detachment, where a retinal "break" allows the ingress of fluid from the vitreous cavity to the subretinal space, resulting in retinal separation. It occurs in about 1 in 10,000 people a year.

  This review considers only acute progressive RRD.
- Cryotherapy and photocoagulation are widely used for preventing progression from retinal breaks or lattice degeneration to RRD, and there is consensus that they are effective, particularly in people with symptomatic flap tears and retinal dialysis.
- There is consensus that scleral buckling, pneumatic retinopexy, and vitrectomy are all effective for treating RRD.

We found insufficient evidence to assess effects of scleral buckling compared with pneumatic retinopexy.

The effects of scleral buckling compared with primary vitrectomy are unclear. There is limited evidence that, in phakic RRD, scleral buckling improves visual acuity at 1 year, and is associated with a reduced risk of development or progression of cataract. However, in pseudophakic and aphakic RRD, rates of retinal re-attachment after one operation are lower post scleral buckling compared with post-vitrectomy.

- In people undergoing vitrectomy for RRD with severe proliferative vitreoretinopathy (occurring as a complication of retinal detachment or previous treatment for retinal detachment), silicone oil and long-acting gas are equally effective for increasing re-attachment rates and improving visual acuity; silicone oil is better than short-acting gas.
- We found insufficient evidence assessing the effects of fluorouracil plus heparin, corticosteroids, or daunorubicin given during vitrectomy surgery for proliferative vitreoretinopathy.

DEFINITION

Retinal detachment can be defined as the separation of the neurosensory retina from the underlying retinal pigment epithelium (RPE). Direct apposition of the retina to the RPE is essential for normal retinal function, and retinal detachment involving the foveal centre leads to profound loss of vision in the affected eye. [1] [2] **Rhegmatogenous retinal detachment (RRD)** is the most common form of retinal detachment, where a retinal "break" allows the ingress of fluid from the vitreous cavity to the subretinal space, resulting in retinal separation. Retinal break refers to a full-thickness defect in the neurosensory retina. Retinal breaks that develop from a tear in the retina at the time of posterior vitreous detachment (PVD) are usually referred to as retinal tears. Lattice degeneration can lead to the formation of circular retinal holes, which are typically referred to as atrophic holes. Retinal breaks can also develop as a result of trauma to and inflammation of the eye: examples include retinal dialysis, which is typically secondary to blunt trauma, and tears associated with retinal necrosis, resulting from trauma or inflammation. Rarer causes of retinal detachment include: tractional retinal detachment secondary to fibrous tissue on the surface of the retina; exudative retinal detachment as a result of choroidal tumours that produce increased fluid flow through the subretinal space; [3] and ocular inflammatory conditions. Retinal detachments can also be a mixture of two or more of the above types. Asymptomatic and non-progressive chronic retinal detachment can also occur. This review considers only acute progressive RRD. **Diagnosis:** RRD is often, but not universally, associated with symptoms of flashes of light (retinal photopsia), visual floaters, and peripheral and usually progressive visual field loss. It is diagnosed by ophthalmoscopy. Acute RRD is seen as an oedematous folded retina with loss of the normal retinal transparency. The detachment can assume a bullous configuration that moves when the eye moves. There can be associated signs of PVD, as well as vitreous haemorrhage or RPE cells circulating in the vitreous cavity after retinal break formation. The presence of pigment cells in the anterior vitreous — visible on slit-lamp biomicroscopy (termed "Shafer's sign") — is a sensitive indicator of the presence of a retinal break in a person presenting with an acute PVD. [4] Chronic retinal detachments can be associated with retinal cyst formation and "tidemarks" demarcating the extent of the detachment, as well as subretinal fibrosis. [1] [2]

INCIDENCE/ PREVALENCE

RRD can occur at any age, but reaches peak prevalence in people aged 60 to 70 years. [5] [6] [7] It affects men more than women, and white people more than black people. Observational studies from the USA, Europe, and New Zealand found that non-traumatic, phakic (lens intact) RRD occurred in about 6 to 18/100,000 people a year (i.e., about 1/10,000). [5] [6] [7] [8] [9] [10] [11]

AETIOLOGY/ RISK FACTORS

The occurrence of retinal detachment is related to the interplay between predisposing retinal lesions and vitreoretinal traction, and occurs when fluid moves from the vitreous cavity through a retinal break into the subretinal space. [12] Most (80–90%) retinal detachments are associated with retinal-break formation at the time of PVD. [13] [14] PVD is a naturally occurring phenomenon, with a rapidly increasing prevalence in the 60- to 70-year-old age group. Most (70%) retinal breaks formed at the time of PVD are seen as tears in the retina, or as holes with a free-floating retinal operculum. Retinal breaks can occur in areas of previously abnormal retina — for example, lattice degeneration. [14] [15] Symptoms and signs of acute PVD are known to be associated with a higher risk of immediate progression to RRD in people with predisposing retinal lesions. However, people with established (chronic) PVD and predisposing retinal lesions who have not immediately progressed to RRD are at lower risk than those without a PVD. Symptomatic retinal tears with persistent vitreoretinal traction (not a complete PVD) have a high rate of progression to retinal detachment (>50% if left untreated). [16] The risk of retinal detachment is increased to a variable extent in people with a symptomatic pre-existing retinal disease or lesions, especially retinal-flap tears, operculated retinal holes after separation of a retinal flap, atrophic retinal holes, lattice degeneration (areas of retinal thinning with abnormal vitreoretinal adhesion), and retinal dialyses. Autopsy studies have shown that about 6% to 11% of people aged over 20 years have retinal breaks in one form or another. However, the chances of an RRD occurring in an asymptomatic eye with a retinal break and with no history of fellow-eye RRD is 0.5% over a follow-up period of 11 years. [17] [18] Similarly, 7% to 8% of adults have areas of lattice degeneration, but only a small proportion of these lesions

progress to RRD. [17] [19] [20] [21] Asymptomatic retinal dialysis is thought to have a high risk of progression to retinal detachment, especially after trauma. [22] [23] Increased risk of RRD is associated with several factors. There is a higher prevalence of RRD in short-sighted (myopic) people, [24] with around a 10-fold increased incidence in people with over 3 dioptres of myopia. [25] The fellow eye in people with an RRD is at a higher risk, with 2% to 10% of RRDs being bilateral. [26] [27] [28] [29] [30] Although some RRD occurring in a fellow eye will develop from pre-existing retinal lesions, most subsequent RRD (at least 50%, and possibly as high as 80–90%) in the fellow eye will occur from ophthalmoscopically normal areas of retina, [14] and so prophylaxis to visible abnormal areas may not completely reduce the incidence of fellow-eye RRD. There is also a higher incidence of RRD in people with a family history of retinal detachment, especially in conditions such as Stickler's syndrome. People who have had previous cataract surgery also have a higher incidence of RRD. About 0.5% to 0.6% of people experience RRD after phacoemulsification surgery for cataracts, with the risk being increased by 15 to 20 times with rupture of the posterior capsule. [31] [32] About 10% of RRDs are associated with trauma. There are other conditions which, more rarely, increase the risk of RRD, including uveitis — especially CMV retinitis — and other degenerative retinal conditions, such as retinoschisis. Idiopathic macular holes may cause RRD in highly myopic eyes, but rarely in emmetropic or hypermetropic eyes.

PROGNOSIS

On presentation, retinal detachment is usually divided into "macula on", when the fovea is still attached, and "macula off", where the retina is detached centrally. [33] People with macula-on retinal detachments typically have good initial visual acuity, and a better prognosis with successful surgery. Rapidly progressive cases are therefore treated as a matter of urgency. Macula-off retinal detachments have worse initial visual acuity, and have a worse prognosis even with successful re-attachment of the retina. Overall, about 95% of people have anatomically successful repair of RRD, with 70% to 90% achieving this in one operation. In 90% of successfully repaired macula-on retinal detachments, vision is 6/12 or better. However, in those with macula-off retinal detachments, only 50% of eyes achieve a visual acuity of 6/15, and, if the macula has been detached for 1 week or more, this level of visual acuity is rarely achieved. [33] Reasons for anatomical failure of surgery include new or missed retinal breaks, and proliferative vitreoretinopathy (PVR). PVR is classified based on extent, position, and type of PVR: the American Retina Society proposed the first classification of PVR in 1983, [34] and, although updated in 1991 following the Silicone Oil Study, [35] this classification system continues to be widely used. Causes of poor visual acuity after successful repair include macular epiretinal membranes (fibrosis), cystoid macular oedema, and foveal photoreceptor degeneration in macula-off retinal detachments. [36]

AIMS OF INTERVENTION

To prevent progression from retinal breaks or lattice degeneration to RRD; to achieve retinal re-attachment in people with RRD; to achieve retinal re-attachment in people with PVR occurring as a complication of RRD or previous treatment for RRD; to achieve these aims with minimal re-operation rates and adverse effects of treatment.

OUTCOMES

Prevention: **rates of progression** (from retinal breaks or lattice degeneration to retinal detachment), **complications** (loss of visual acuity or adverse effects of treatment). *Treatment:* **Anatomical re-attachment rate** (after one operation and final rate), **re-operation rate**, **visual acuity**. *Treatment of eyes with proliferative vitreoretinopathy:* **rate of retinal re-attachment** (after one operation and final rate), **re-operation rate**, **visual acuity**. **Adverse effects**: axial length and refractive change, cataract, chronic hypotony, endophthalmitis, extraocular muscle dysfunction and diplopia, glaucoma, keratopathy, macular oedema, macular pucker, raised intraocular pressure, re-detachment, subretinal and choroidal haemorrhage, PVR associated with initial treatment.

METHODS

Clinical Evidence search and appraisal June 2010. The following databases were used to identify studies for this systematic review: Medline 1966 to June 2010, Embase 1980 to June 2010, and The Cochrane Database of Systematic Reviews 2010 May (1966 to date of issue). An additional search within The Cochrane Library was carried out for the Database of Abstracts of Reviews of Effects (DARE) and Health Technology Assessment (HTA). We also searched for retractions of studies included in the review. Abstracts of the studies retrieved from the initial search were assessed by an information specialist. Selected studies were then sent to the contributor for additional assessment, using predetermined criteria to identify relevant studies. Study design criteria for inclusion in this review were: published systematic reviews of RCTs and RCTs in any language, at least single blinded, and containing more than 20 individuals of whom more than 80% were followed up. There was no minimum length of follow-up required to include studies. We excluded all studies described as "open", "open label", or not blinded unless blinding was impossible. We included systematic reviews of RCTs and RCTs where harms of an included intervention were studied applying the same study design criteria for inclusion as we did for benefits. In addition, we use a regular surveillance protocol to capture harms alerts from organisations such as the US Food and Drug Administration (FDA) and the UK Medicines and Healthcare products Regulatory Agency

(MHRA), which are added to the reviews as required. Scleral buckling surgery has been the mainstay of treatment for RRD for many years, and there is consensus that it is effective in cases where it is possible to close the retinal breaks with scleral indentation. We have therefore compared scleral buckling versus other surgical techniques (pneumatic retinopexy and vitrectomy). Various visual acuity scales have been used by the RCTs in the review; results for visual acuity are reported as cited in the original studies. See table 1, p 34 for an illustration of how the scales compare. To aid readability of the numerical data in our reviews, we round many percentages to the nearest whole number. Readers should be aware of this when relating percentages to summary statistics such as relative risks (RRs) and odds ratios (ORs). We have performed a GRADE evaluation of the quality of evidence for interventions included in this review (see table, p 35). The categorisation of the quality of the evidence (high, moderate, low, or very low) reflects the quality of evidence available for our chosen outcomes in our defined populations of interest. These categorisations are not necessarily a reflection of the overall methodological quality of any individual study, because the Clinical Evidence population and outcome of choice may represent only a small subset of the total outcomes reported, and population included, in any individual trial. For further details of how we perform the GRADE evaluation and the scoring system we use, please see our website (www.clinicalevidence.com).

QUESTION **What are the effects of interventions to prevent progression from retinal breaks or lattice degeneration to retinal detachment?**

OPTION **CRYOTHERAPY (CRYOPEXY)**

- For GRADE evaluation of interventions for Retinal detachment, see table, p 35 .
- Cryotherapy is widely used for preventing progression from retinal breaks or lattice degeneration to rhegmatogenous retinal detachment (RRD), and there is consensus that it is effective, particularly in people with symptomatic flap tears and retinal dialysis.

Benefits and harms

Cryotherapy:

We found one systematic review (search date 2006), which identified no RCTs assessing cryotherapy for preventing progression from asymptomatic retinal breaks or lattice degeneration to RRD. [37]

Further information on studies

Comment:

Clinical guide:

Transclerally applied cryotherapy and transpupillary laser photocoagulation are widely used to treat predisposing retinal lesions in an attempt to prevent progression to rhegmatogenous retinal detachment (RRD). We found one systematic review (search date not reported), which made consensus recommendations supported primarily by retrospective observational studies. [38] Their consensus recommendations suggested that one should "always treat" symptomatic flap tears prophylactically, and "almost always treat" people with retinal dialysis regardless of symptoms. One should "sometimes treat" asymptomatic flap tears and symptomatic operculated tears, especially if eyes have other risk factors for RRD, such as previous RRD in the fellow eye or myopia. One should also "sometimes treat" people with lattice degeneration in fellow eyes of those experiencing RRD prophylactically, unless the eye has more than 6 dioptres of myopia, or more than 6 clock hours of lattice degeneration. The method of prophylactic treatment was not specified in the review. [38] The choice of cryotherapy or laser photocoagulation is dependent on the experience of the clinician, the availability of the technology, and clinical appropriateness. Cryotherapy can be applied to the retina in an eye with severe media opacity that precludes the use of laser photocoagulation. Cryotherapy is also easier to apply than laser photocoagulation if pupil size is small and the retinal lesion is anterior. [2] [39] Laser photocoagulation is more easily applied to posterior retinal pathology than is cryotherapy, which would require conjunctival opening to treat posterior lesions. [2] [39] Laser photocoagulation is also considered effective in people with symptomatic flap tears or retinal dialysis. Clinical experience suggests that complications of prophylactic treatment can be divided into three groups: failure to prevent retinal detachment, new retinal break formation, and later adverse

effects such as macular pucker. However, macular-pucker formation occurs as a primary complication after posterior vitreous detachment, and is reported as occurring in 1% to 2% of people after preventive treatment with either cryotherapy or laser photocoagulation — similar to the rates of untreated eyes with predisposing retinal lesions. [12] Other rarer complications include: choroidal detachment, which may cause anterior chamber shallowing; myopia or reduced accommodation; raised intraocular pressure; pupillary dilation with visual glare; and vitreous haemorrhage. Cryotherapy delivered transclerally is associated with transient postoperative conjunctival erythema, chemosis, and irritation.

OPTION LASER PHOTOCOAGULATION

- For GRADE evaluation of interventions for Retinal detachment, see table, p 35 .
- Photocoagulation is widely used for preventing progression from retinal breaks or lattice degeneration to rhegmatogenous retinal detachment (RRD), and there is consensus that it is effective, particularly in people with symptomatic flap tears and retinal dialysis.

Benefits and harms

Laser photocoagulation:

We found one systematic review (search date 2006), which identified no RCTs assessing laser photocoagulation for preventing progression from asymptomatic retinal breaks or lattice degeneration to RRD. [37]

Further information on studies

Comment: **Clinical guide:**
See comment on cryotherapy, p 4 .

QUESTION What are the effects of different surgical interventions in people with rhegmatogenous retinal detachment?

OPTION SCLERAL BUCKLING VERSUS PNEUMATIC RETINOPEXY

- For GRADE evaluation of interventions for Retinal detachment, see table, p 35 .
- There is consensus that scleral buckling and pneumatic retinopexy are both effective for treating rhegmatogenous retinal detachment (RRD). However, we found insufficient evidence to assess the effects of scleral buckling compared with pneumatic retinopexy.
- Scleral buckling has been associated with higher rates of refractive change (usually a myopic shift in refraction), diplopia with extraocular muscle dysfunction, and subretinal haemorrhage compared with pneumatic retinopexy.

Benefits and harms

Scleral buckling versus pneumatic retinopexy:

We found two RCTs. [40] [41]

Re-attachment rate

Scleral buckling compared with pneumatic retinopexy Scleral buckling and pneumatic retinopexy seem equally effective at increasing re-attachment rates (after one operation and final rate) in people with phakic, pseudophakic, or aphakic rhegmatogenous retinal detachment (RRD) and superior retinal breaks (moderate-quality evidence).

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Re-attachment rates					
[40] RCT	198 eyes with phakic (108 eyes), pseudophakic (70 eyes), or aphakic (20 eyes) rhegmatogenous retinal detachment (RRD), involving retinal breaks within 1 disc diameter of each other located in the superior retina, without severe proliferative vitreoretinopathy (PVR)	**Re-attachment rates after one operation , 6 months** 78/95 (82%) eyes with scleral buckling 75/103 (73%) eyes with pneumatic retinopexy	Reported as not significant P value not reported	⟷	Not significant
[40] RCT	198 eyes with phakic (108 eyes), pseudophakic (70 eyes), or aphakic (20 eyes) RRD, involving retinal breaks within 1 disc diameter of each other located in the superior retina, without severe PVR	**Final re-attachment rates** 93/95 (98%) eyes with scleral buckling 102/103 (99%) eyes with pneumatic retinopexy	Reported as not significant P value not reported	⟷	Not significant
[41] RCT	20 people with RRD and single retinal break or small group of breaks in phakic or pseudophakic eyes without severe PVR	**Re-attachment rate** 8/10 (80%) with scleral buckling 7/10 (70%) with pneumatic retinopexy	Significance not assessed		

Visual acuity

Scleral buckling compared with pneumatic retinopexy Scleral buckling and pneumatic retinopexy seem equally effective at improving visual acuity in people with phakic, pseudophakic, or aphakic rhegmatogenous retinal detachment and superior retinal breaks. However, in eyes with preoperative detachment of the macula for up to 14 days, scleral buckling seems less effective at improving visual acuity (moderate-quality evidence).

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Visual acuity					
[40] RCT	198 eyes with phakic (108 eyes), pseudophakic (70 eyes), or aphakic (20 eyes) rhegmatogenous retinal detachment (RRD), involving retinal breaks within 1 disc diameter of each other located in the superior retina, without severe proliferative vitreoretinopathy (PVR)	**Proportion of eyes with visual acuity of 20/50 or better on the Snellen scale , 6 months** 64/95 (68%) eyes with scleral buckling 90/103 (87%) eyes with pneumatic retinopexy See further information on studies for details on final visual outcome after successful repair compared with failed surgery	Significance not assessed		

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
[40] RCT	198 eyes with phakic (108 eyes), pseudophakic (70 eyes), or aphakic (20 eyes) RRD, involving retinal breaks within 1 disc diameter of each other located in the superior retina, without severe PVR	**Proportion of eyes with visual acuity of 20/25** 12/95 (13%) eyes with scleral buckling 25/103 (24%) eyes with pneumatic retinopexy See further information on studies for details on final visual outcome after successful repair compared with failed surgery	Reported as not significant P = 0.05	⟷	Not significant
[40] RCT	109 eyes with preoperative detachment of the macula for up to 14 days Subgroup analysis There were insufficient data to assess eyes with macula detachment for more than 14 days	**Proportion of eyes with visual acuity of 20/50 or better on the Snellen scale** 27/48 (56%) eyes with scleral buckling 49/61 (80%) eyes with pneumatic retinopexy	P = 0.01	○○○	Pneumatic retinopexy

No data from the following reference on this outcome. [41]

Re-operation rate

No data from the following reference on this outcome. [40] [41]

Adverse effects

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Adverse effects					
[40] RCT	198 eyes with phakic (108 eyes), pseudophakic (70 eyes), or aphakic (20 eyes) rhegmatogenous retinal detachment (RRD), involving retinal breaks within 1 disc diameter of each other located in the superior retina, without severe proliferative vitreoretinopathy (PVR)	**Proportion of eyes with at least 1 dioptre of myopia** 65/95 (68%) eyes with scleral buckling 3/103 (3%) eyes with pneumatic retinopexy	P = 0.0001	○○○	Pneumatic retinopexy
[40] RCT	198 eyes with phakic (108 eyes), pseudophakic (70 eyes), or aphakic (20 eyes) RRD, involving retinal breaks within 1 disc diameter of each other located	**Persistent diplopia** 3/95 (3%) eyes with scleral buckling 0/103 (0%) eyes with pneumatic retinopexy	Significance not assessed		

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
	in the superior retina, without severe PVR				
[40] RCT	198 eyes with phakic (108 eyes), pseudophakic (70 eyes), or aphakic (20 eyes) RRD, involving retinal breaks within 1 disc diameter of each other located in the superior retina, without severe PVR	**Proliferative vitreoretinopathy (PVR)** 5/95 (5%) eyes with scleral buckling 3/103 (3%) eyes with pneumatic retinopexy	Significance not assessed		
[40] RCT	198 eyes with phakic (108 eyes), pseudophakic (70 eyes), or aphakic (20 eyes) RRD, involving retinal breaks within 1 disc diameter of each other located in the superior retina, without severe PVR	**Macular pucker requiring surgery** 2/95 (2%) eyes with scleral buckling 0/103 (0%) eyes with pneumatic retinopexy	Significance not assessed		
[40] RCT	198 eyes with phakic (108 eyes), pseudophakic (70 eyes), or aphakic (20 eyes) RRD, involving retinal breaks within 1 disc diameter of each other located in the superior retina, without severe PVR	**Macular subretinal haemorrhage** 2/95 (2%) eyes with scleral buckling 0/103 (0%) eyes with pneumatic retinopexy	Significance not assessed		
[40] RCT	108 phakic eyes Subgroup analysis	**Progressive lens opacities , 24 months** 21/44 (47%) eyes with scleral buckling 10/53 (19%) eyes with pneumatic retinopexy	Significance not assessed		
[40] RCT	108 phakic eyes Subgroup analysis	**Proportion of people requiring cataract surgery** 8/44 (18%) eyes with scleral buckling 2/53 (4%) eyes with pneumatic retinopexy	Significance not assessed	○○○	Scleral buckling
[41] RCT	20 people with RRD and single retinal break or small group of breaks in phakic or pseudophakic eyes without severe PVR	**Proliferative vitreoretinopathy (PVR) with RRD** 0/10 (0%) eyes with scleral buckling 2/10 (20%) eyes with pneumatic retinopexy One person in each group had re-detachment because of new retinal holes	Significance not assessed		

Further information on studies

[40] The RCT found no significant difference in final visual outcome between eyes with successful RRD repair with initial scleral buckling surgery and eyes that failed with initial pneumatic retinopexy and required further surgery (P >0.05; absolute data for final vision outcome in each group not reported).

Comment:

Clinical guide:
Rhegmatogenous retinal detachment (RRD) is repaired using techniques to close retinal breaks and relieve vitreoretinal traction. Although some RRDs could potentially be repaired by all 3 surgical techniques (scleral buckling, vitrectomy, or pneumatic retinopexy), this is not universally the case, and choice of surgery will depend on various factors, including: the number, location, and size of retinal breaks present; the ability of the patient to posture to position tamponade agents in the correct place; lens status; and surgeon experience, including access to equipment. Vitrectomy techniques require specialist training, and equipment is expensive; access is thus limited in resource-poor areas. In clinical practice in the UK, Europe, and North America, people with phakic eyes and localised RRD with small anterior holes or retinal dialysis are usually treated with scleral buckling, especially if there is no associated posterior vitreous detachment. Eyes in which a scleral buckle cannot be placed (e.g., thin sclera) and people with vitreous opacity obstructing the retinal view, giant retinal breaks, or very posterior retinal breaks are usually treated with vitrectomy. Pneumatic retinopexy is usually reserved for people with a single or localised group of breaks in the superior retina. People with pseudophakic RRD represent about 40% of all RRD that presents in clinical practice in the UK. Retinal breaks in these cases are often small and difficult to see because of the intraocular lens and capsule remnants restricting the fundal view. There is an increasing trend to treat these people with vitrectomy, which allows accurate break localisation with the technique of internal searching. Furthermore, with the eye already being pseudophakic, a common adverse effect of vitrectomy surgery — cataract formation — is avoided.

OPTION SCLERAL BUCKLING VERSUS PRIMARY VITRECTOMY

- For GRADE evaluation of interventions for Retinal detachment, see table, p 35 .
- There is consensus that scleral buckling and primary vitrectomy are both effective for treating rhegmatogenous retinal detachment (RRD).
- The effects of scleral buckling compared with primary vitrectomy are unclear. There is limited evidence that, in phakic RRD, scleral buckling improves visual acuity at 1 year, and is associated with a reduced risk of development or progression of cataract. However, in pseudophakic and aphakic RRD, rates of retinal re-attachment after one operation are lower post-scleral buckling compared with post-vitrectomy.
- Scleral buckling has been associated with higher rates of refractive change (usually a myopic shift in refraction), diplopia with extraocular muscle dysfunction, and subretinal haemorrhage compared with vitrectomy. Vitrectomy has been associated with higher rates of cataract formation in phakic eyes compared with scleral buckling.

Benefits and harms

Scleral buckling versus primary vitrectomy in pseudophakic or aphakic rhegmatogenous retinal detachment (RRD):

We found 4 RCTs in people with pseudophakic or aphakic RRD. [42] [43] [44] [45]

Re-attachment rate

Scleral buckling compared with primary vitrectomy in people with pseudophakic or aphakic rhegmatogenous retinal detachment Scleral buckling may be less effective at increasing re-attachment rates after one operation at 6 months to 1 year, but equally effective as primary vitrectomy at increasing final re-attachment rates (low-quality evidence).

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Re-attachment rates					
[42] RCT	150 people, 150 eyes with pseudophakic rheg-	**Re-attachment rate after 1 operation** 62/75 (83%) with scleral buckling	P = 0.037	◌◌◌	vitrectomy

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
	matogenous retinal detachment (RRD)	71/75 (94%) with pars plana vitrectomy with infusion of short-acting gas Length of follow-up not clear			
[42] RCT	150 people, 150 eyes with pseudophakic RRD	**Final re-attachment rate (includes those who required more than 1 operation)** 71/75 (94%) with scleral buckling 74/75 (99%) with pars plana vitrectomy with infusion of short-acting gas	P = 0.37	⟷	Not significant
[43] RCT	50 people, 50 eyes with pseudophakic RRD	**Re-attachment rate after 1 operation , 6 months** 19/25 (76%) with scleral buckling 21/25 (84%) with pars plana vitrectomy with infusion of long-acting gas	P = 0.48	⟷	Not significant
[43] RCT	50 people, 50 eyes with pseudophakic RRD	**Final re-attachment rate (includes those who required more than 1 operation)** 25/25 (100%) with scleral buckling 25/25 (100%) with pars plana vitrectomy with infusion of long-acting gas	Significance not assessed		
[44] RCT	225 people, 225 eyes with pseudophakic or aphakic RRD	**Re-attachment rate after 1 operation , 6 months** 86/126 (68%) with scleral buckling 62/99 (63%) with pars plana vitrectomy with infusion of short-acting gas	OR 1.28 95% CI 0.73 to 2.24	⟷	Not significant
[44] RCT	225 people, 225 eyes with pseudophakic or aphakic RRD	**Final re-attachment rate (includes those who required more than 1 operation)** 85% with scleral buckling 92% with pars plana vitrectomy with infusion of short-acting gas Absolute numbers not reported	Significance not assessed		
[45] RCT	265 people, 265 eyes with pseudophakic or aphakic RRD Subgroup analysis In addition to other inclusion criteria, people with unseen breaks were included in this subgroup Total population was 681 people (see further information on studies for full details)	**Primary anatomical success rate , 1 year** 71/133 (53%) with scleral buckling 95/132 (72%) with pars plana vitrectomy with infusion of short-acting gas Primary anatomical success defined as retinal re-attachment without a retina-affecting re-operation The RCT reported that scleral buckling was used in the vitrectomy group (see further information on studies for full details)	OR 0.44 95% CI 0.26 to 0.75 P = 0.002 Results should be interpreted with caution (see further information on studies for full details)	●○○	Vitrectomy

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
[45] RCT	265 people, 265 eyes with pseudophakic or aphakic RRD Subgroup analysis In addition to other inclusion criteria, people with unseen breaks were included in this subgroup Total population was 681 people (see further information on studies for full details)	**Final anatomical success rate** 124/133 (93%) with scleral buckling 126/132 (96%) with pars plana vitrectomy with infusion of short-acting gas Final anatomical success defined as retinal re-attachment at final follow-up visit; any type of re-operation allowed The RCT reported that scleral buckling was used in the vitrectomy group (see further information on studies for full details)	OR 0.62 95% CI 0.21 to 1.86 P = 0.09686 Results should be interpreted with caution (see further information on studies for full details)	⟷	Not significant

Visual acuity

Scleral buckling compared with primary vitrectomy We don't know how scleral buckling and primary vitrectomy compare at improving visual acuity at 6 months to 1 year in people with pseudophakic or aphakic rhegmatogenous retinal detachment (low-quality evidence).

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Visual acuity					
[42] RCT	150 people, 150 eyes with pseudophakic rhegmatogenous retinal detachment (RRD)	**Mean visual acuity on the logMAR scale , 1 year** 0.40 with scleral buckling 0.33 with pars plana vitrectomy with infusion of short-acting gas	P = 0.26	⟷	Not significant
[42] RCT	150 people, 150 eyes with pseudophakic RRD	**Proportion of people with vision of 20/40 or better on Snellen scale , 1 year** 49/75 (65%) with scleral buckling 54/75 (72%) with pars plana vitrectomy with infusion of short-acting gas	Significance not assessed		
[43] RCT	50 people, 50 eyes with pseudophakic RRD	**Mean best corrected Snellen visual acuity (BCVA, expressed as a decimal) , 6 months** 0.19 with scleral buckling 0.28 with pars plana vitrectomy with infusion of long-acting gas	P = 0.034	○○○	vitrectomy
[44] RCT	225 people, 225 eyes with pseudophakic or aphakic RRD	**Proportion of eyes with a visual acuity of 20/40 or better on the Snellen scale , 6 months** 11/86 (13%) with scleral buckling 7/62 (11%) with pars plana vitrectomy with infusion of short-acting gas	P = 0.78	⟷	Not significant
[45] RCT	265 people, 265 eyes with pseudophakic or aphakic RRD Subgroup analysis In addition to other inclusion criteria, people with un-	**Mean BCVA (logMAR units) , 1 year** 0.46 with scleral buckling 0.38 with pars plana vitrectomy with infusion of short-acting gas The RCT reported that scleral buckling was used in the vitrecto-	Treatment difference +0.09 95% CI –0.02 to +0.2 P = 0.1033 Results should be interpreted with caution (see further information on studies for full details)	⟷	Not significant

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
	seen breaks were included in this subgroup Total population was 681 people (see further information on studies for full details)	my group (see further information on studies for full details)			

Re-operation rate

Scleral buckling compared with primary vitrectomy in people with pseudophakic or aphakic rhegmatogenous retinal detachment Scleral buckling and primary vitrectomy seem equally effective at reducing re-operation rate (moderate-quality evidence).

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Re-operation rate					
[42] RCT	150 people, 150 eyes, with pseudophakic rhegmatogenous retinal detachment	**Re-operation rate** 13/75 (17%) with scleral buckling 4/75 (5%) with pars plana vitrectomy with infusion of short-acting gas	P = 0.38	⟷	Not significant

No data from the following reference on this outcome. [43] [44] [45]

Adverse effects

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Diplopia					
[42] RCT	150 people, 150 eyes with pseudophakic rhegmatogenous retinal detachment (RRD)	**Diplopia** 3/75 (4%) with scleral buckling 0/75 (0%) with pars plana vitrectomy with infusion of short-acting gas	P = 0.25	⟷	Not significant
[43] RCT	50 people, 50 eyes with pseudophakic RRD	**Diplopia** 1/25 (4%) with scleral buckling 0/25 (0%) with pars plana vitrectomy with infusion of long-acting gas	Significance not assessed		
Proliferative vitreoretinopathy					
[43] RCT	50 people, 50 eyes with pseudophakic RRD	**Proliferative vitreoretinopathy (PVR)** 5/25 (20%) with scleral buckling 1/25 (4%) with pars plana vitrectomy with infusion of long-acting gas	Significance not assessed		

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
[45] RCT	265 people, 265 eyes with pseudophakic or aphakic RRD Subgroup analysis In addition to other inclusion criteria, people with unseen breaks were included in this subgroup Total population was 681 people (see further information on studies for full details)	**PVR** 30/133 (23%) with scleral buckling 20/132 (15%) with pars plana vitrectomy with infusion of short-acting gas The RCT reported that scleral buckling was used in the vitrectomy group (see further information on studies for full details)	P = 0.1073 Results should be interpreted with caution (see further information on studies for full details)	⟷	Not significant
Macular pucker					
[42] RCT	150 people, 150 eyes with pseudophakic RRD	**Macular pucker** 3/75 (4%) with scleral buckling 2/75 (3%) with pars plana vitrectomy with infusion of short-acting gas	P = 0.99	⟷	Not significant
[44] RCT	225 people, 225 eyes with pseudophakic or aphakic RRD	**Macular pucker** 22% with scleral buckling 22% with pars plana vitrectomy with infusion of short-acting gas Absolute numbers not reported	Significance not assessed		
Retinal re-detachment					
[44] RCT	225 people, 225 eyes with pseudophakic or aphakic RRD	**Retinal re-detachment** 40/126 (32%) with scleral buckling 39/99 (37%) with pars plana vitrectomy with infusion of short-acting gas The RCT reported that re-detachment was caused by new breaks or PVR (see further information on studies section for full details)	Reported as not significant P value not reported	⟷	Not significant
[45] RCT	265 people, 265 eyes with pseudophakic or aphakic RRD Subgroup analysis In addition to other inclusion criteria, people with unseen breaks were included in this subgroup Total population was 681 people (see further information on studies for full details)	**Retinal re-detachment , 1 year** 53/133 (40%) with scleral buckling 27/132 (20%) with pars plana vitrectomy with infusion of short-acting gas The RCT reported that scleral buckling was used in the vitrectomy group (see further information on studies for full details)	Significance not assessed Results should be interpreted with caution (see further information on studies for full details)		
General adverse effects					
[42] RCT	150 people, 150 eyes with pseudophakic RRD	**Postoperative retinal breaks** 5/75 (7%) with scleral buckling	Significance not assessed		

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
		1/75 (1%) with pars plana vitrectomy with infusion of short-acting gas			
[42] RCT	150 people, 150 eyes with pseudophakic RRD	**Choroidal haemorrhage or subretinal haemorrhage related to subretinal fluid drainage** 8/75 (11%) with scleral buckling 0/75 (0%) with pars plana vitrectomy with infusion of short-acting gas	Significance not assessed		
[42] RCT	150 people, 150 eyes with pseudophakic RRD	**Mean axial length** 0.95 mm with scleral buckling 0.1 mm with pars plana vitrectomy with infusion of short-acting gas	P = 0.0001	○○○	vitrectomy
[43] RCT	50 people, 50 eyes with pseudophakic RRD	**Raised intraocular pressure** 1/25 (4%) with scleral buckling 8/25 (32%) with pars plana vitrectomy with infusion of long-acting gas	Significance not assessed		
[43] RCT	50 people, 50 eyes with pseudophakic RRD	**Cellophane maculopathy** 4/25 (16%) with scleral buckling 3/25 (12%) with pars plana vitrectomy with infusion of long-acting gas	Significance not assessed		
[43] RCT	50 people, 50 eyes with pseudophakic RRD	**Myopic shift (mean change in refractive error)** –1.38 dioptres of myopia with scleral buckling –0.85 dioptres of myopia with pars plana vitrectomy with infusion of long-acting gas	Significance not assessed		
[44] RCT	225 people, 225 eyes with pseudophakic or aphakic RRD	**Macular oedema** 6% with scleral buckling 10% with pars plana vitrectomy with infusion of short-acting gas Absolute numbers not reported	Significance not assessed		
[44] RCT	225 people, 225 eyes with pseudophakic or aphakic RRD	**Extraocular muscle dysfunction** 4% with scleral buckling 0% with pars plana vitrectomy with infusion of short-acting gas Absolute numbers not reported	Significance not assessed		

Scleral buckling versus primary vitrectomy in phakic rhegmatogenous retinal detachment (RRD):

We found 3 RCTs in people with phakic RRD. [45] [46] [47]

Re-attachment rate

Scleral buckling compared with primary vitrectomy in people with phakic rhegmatogenous retinal detachment We don't know how scleral buckling and primary vitrectomy compare at increasing re-attachment rates after one operation at 6 months to 1 year (very low-quality evidence).

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Re-attachment rate					
[45] RCT	416 people, 416 eyes with phakic rhegmatogenous retinal detachment (RRD) Subgroup analysis Total population was 681 people (see further information on studies for full details)	**Primary anatomical success rate , 1 year** 133/209 (63.6%) with scleral buckling 132/207 (63.8%) with pars plana vitrectomy with infusion of short-acting gas Primary anatomical success defined as retinal re-attachment without a retina-affecting re-operation The RCT reported that scleral buckling was used in the vitrectomy group (see further information on studies for full details)	OR 1.01 95% CI 0.68 to 1.49 P = 0.97 Results should be interpreted with caution (see further information on studies for full details)	⟷	Not significant
[45] RCT	416 people, 416 eyes with phakic RRD Subgroup analysis Total population was 681 people (see further information on studies for full details)	**Final anatomical success rate** 202/209 (96.7%) with scleral buckling 200/207 (96.6%) with pars plana vitrectomy with infusion of short-acting gas Final anatomical success defined as retinal re-attachment at final follow-up visit; any type of re-operation allowed The RCT reported that scleral buckling was used in the vitrectomy group (see further information on studies for full details)	OR 1.07 95% CI 0.35 to 3.25 P = 0.90 Results should be interpreted with caution (see further information on studies for full details)	⟷	Not significant
[46] RCT	46 people aged 50 years and older, 46 eyes with phakic RRD involving the macula with recent posterior vitreous detachment and equatorial tears	**Re-attachment rate after 1 operation , 6 months** 21/23 (91%) with scleral buckling 21/23 (91%) with pars plana vitrectomy with infusion of short-acting gas combined with phacoemulsification surgery	Significance not assessed		
[46] RCT	46 people aged 50 years and older, 46 eyes with phakic RRD involving the macula with recent posterior vitreous detachment and equatorial tears	**Final re-attachment rate** 23/23 (100%) with scleral buckling 23/23 (100%) with pars plana vitrectomy with infusion of short-acting gas combined with phacoemulsification surgery	Significance not assessed		
[47] RCT	61 people, 61 eyes, with phakic RRD without proliferative vitreoretinopathy (PVR) of grade C or above	**Primary success rate , 6 months** 25/31 (81%) with scleral buckling 24/30 (80%) with pars plana vitrectomy with infusion of long-acting gas plus 360 laser to peripheral retina	P = 0.213	⟷	Not significant
[47] RCT	61 people, 61 eyes, with phakic RRD without PVR of grade C or above	**Final anatomical success rate , 6 months** 31/31 (100%) with scleral buckling 30/30 (100%) with pars plana vitrectomy with infusion of long-acting gas plus 360 laser to peripheral retina	Significance not assessed		

Visual acuity

Scleral buckling compared with primary vitrectomy We don't know how scleral buckling and primary vitrectomy compare at improving visual acuity at 6 months to 1 year in people with phakic rhegmatogenous retinal detachment (low-quality evidence).

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Visual acuity					
[45] RCT	416 people, 416 eyes with phakic rhegmatogenous retinal detachment (RRD) Subgroup analysis Total population was 681 people (see further information on studies for full details)	**Mean BCVA (logMAR units) , 1 year** 0.33 with scleral buckling 0.48 with pars plana vitrectomy with infusion of short-acting gas The RCT reported that scleral buckling was used in the vitrectomy group (see further information on studies for full details)	Treatment difference 0.15 95% CI 0.00 to 0.29 P = 0.0005 Results should be interpreted with caution (see further information on studies for full details)	○○○	scleral buckling
[46] RCT	46 people aged 50 years and older, 46 eyes with phakic RRD involving the macula with recent posterior vitreous detachment and equatorial tears	**BCVA of 0.8 or more , 6 months** 1/23 (4%) with scleral buckling 12/23 (52%) with pars plana vitrectomy with infusion short-acting gas combined with phacoemulsification surgery	P = 0.001	○○○	vitrectomy
[46] RCT	46 people aged 50 years and older, 46 eyes with phakic RRD involving the macula with recent posterior vitreous detachment and equatorial tears	**Mean BCVA (logMAR) , 6 months** with scleral buckling with pars plana vitrectomy with infusion of short-acting gas combined with phacoemulsification surgery Absolute results reported graphically RCT reported that improvement was greater with vitrectomy	P = 0.005	○○○	vitrectomy
[47] RCT	61 people, 61 eyes, with phakic RRD without proliferative vitreoretinopathy (PVR) of grade C or above	**Mean BCVA (logMAR units) , 1 week** 0.84 with scleral buckling 2.0 with pars plana vitrectomy with infusion of long-acting gas plus 360 laser to peripheral retina	P = 0 (P value as reported in RCT)	○○○	scleral buckling
[47] RCT	61 people, 61 eyes, with phakic RRD without PVR of grade C or above	**Mean BCVA (logMAR units) , 1 month** 0.699 with scleral buckling 1.14 with pars plana vitrectomy with infusion of long-acting gas plus 360 laser to peripheral retina	P = 0.006	○○○	scleral buckling
[47] RCT	61 people, 61 eyes, with phakic RRD without PVR of grade C or above	**Mean BCVA (logMAR units) , 3 months** 0.676 with scleral buckling 0.773 with pars plana vitrectomy with infusion of long-acting gas plus 360 laser to peripheral retina	P = 0.395	⟷	Not significant
[47] RCT	61 people, 61 eyes, with phakic RRD without PVR	**Mean BCVA (logMAR units) , 6 months** 0.608 with scleral buckling	P = 0.376	⟷	Not significant

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
	of grade C or above	0.689 with pars plana vitrectomy with infusion of long-acting gas plus 360 laser to peripheral retina			

Re-operation rate

No data from the following reference on this outcome. [45] [46] [47]

Adverse effects

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Cataracts					
[45] RCT	416 people, 416 eyes with phakic rhegmatogenous retinal detachment (RRD) Subgroup analysis Total population was 681 people (see further information on studies for full details)	**Development or progression of cataracts** 96/209 (46%) with scleral buckling 160/207 (77%) with pars plana vitrectomy with infusion of short-acting gas Development or progression of cataracts defined as an increase of 1 point or more on the LOCS III scale The RCT reported that scleral buckling was used in the vitrectomy group (see further information on studies for full details)	Treatment difference 31.4% 95% CI 22.5% to 40.2% P <0.0001 Results should be interpreted with caution (see further information on studies for full details)	○○○	scleral buckling
[45] RCT	416 people, 416 eyes with phakic RRD Subgroup analysis Total population was 681 people (see further information on studies for full details)	**Surgery to remove cataracts** 43/209 (21%) with scleral buckling 120/207 (58%) with pars plana vitrectomy with infusion of short-acting gas The RCT reported that scleral buckling was used in the vitrectomy group (see further information on studies for full details)	Treatment difference 37.4% 95% CI 28.7% to 46.1% Results should be interpreted with caution (see further information on studies for full details)	○○○	scleral buckling
[47] RCT	61 people, 61 eyes, with phakic RRD without proliferative vitreoretinopathy (PVR) of grade C or above.	**Development of cataract** 0/31 (0%) with scleral buckling 5/30 (17%) with pars plana vitrectomy with infusion of long-acting gas plus 360 laser to peripheral retina	P = 0.018	○○○	scleral buckling
Proliferative vitreoretinopathy					
[45] RCT	416 people, 416 eyes with phakic RRD Subgroup analysis Total population was 681 people (see further information on studies for full details)	**PVR** 26/209 (12%) with scleral buckling 34/207 (16%) with pars plana vitrectomy with infusion of short-acting gas The RCT reported that scleral buckling was used in the vitrecto-	P = 0.2812 Results should be interpreted with caution (see further information on studies for full details)	⟷	Not significant

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
		my group (see further information on studies for full details)			
[46] RCT	46 people aged 50 years and older, 46 eyes with phakic RRD involving the macula with recent posterior vitreous detachment and equatorial tears	**PVR** 1/23 (4%) with scleral buckling 2/23 (9%) with pars plana vitrectomy with infusion of short-acting gas combined with phacoemulsification surgery	Significance not assessed		
Intraocular pressure					
[46] RCT	46 people aged 50 years and older, 46 eyes with phakic RRD involving the macula with recent posterior vitreous detachment and equatorial tears	**Elevation of intraocular pressure (>30 mmHg)** 3/23 (13%) with scleral buckling 4/23 (17%) with pars plana vitrectomy with infusion of short-acting gas combined with phacoemulsification surgery	Significance not assessed		
[47] RCT	61 people, 61 eyes, with phakic RRD without PVR of grade C or above	**Elevated of intraocular pressure** 2/31 (6.5%) with scleral buckling 2/30 (6.7%) with pars plana vitrectomy with infusion of long-acting gas plus 360 laser to peripheral retina The RCT reported that intraocular pressure increase was managed successfully with medication	Significance not assessed		
Other adverse effects					
[45] RCT	416 people, 416 eyes with phakic RRD Subgroup analysis Total population was 681 people (see further information on studies for full details)	**Retinal re-detachment , 1 year** 55/209 (26%) with scleral buckling 52/207 (25%) with pars plana vitrectomy with infusion of short-acting gas The RCT reported that scleral buckling was used in the vitrectomy group (see further information on studies for full details)	Significance not assessed Results should be interpreted with caution (see further information on studies for full details)		
[46] RCT	46 people aged 50 years and older, 46 eyes with phakic RRD involving the macula with recent posterior vitreous detachment and equatorial tears	**Macular pucker** 4/23 (17%) with scleral buckling 0/23 (0%) with pars plana vitrectomy with infusion of short-acting gas combined with phacoemulsification surgery	Significance not assessed		
[47] RCT	61 people, 61 eyes, with phakic RRD without PVR of grade C or above	**Epiretinal membrane** 1/31 (3.2%) with scleral buckling 1/30 (3.3%) with pars plana vitrectomy with infusion of long-acting gas plus 360 laser to peripheral retina	Significance not assessed		

Further information on studies

[45] The multicentre RCT (45 surgeons) included 681 people, 681 eyes with RRD involving multiple large breaks between 1 and 2 clock hours in size and associated superior bullous RRD. The RCT reported that additional scleral buckling was used (carried out at surgeon's discretion) at the time of primary surgery in 88/132 (67%) of people with pseudophakic or aphakic RRD assigned to vitrectomy, and in 105/207 (51%) of people with phakic RRD assigned to vitrectomy. The RCT did not carry out separate analysis on the effects of combined surgery versus scleral buckling alone. Results should be interpreted with caution, as the true effects of vitrectomy alone are unclear.

Comment: **Clinical guide:**
See scleral buckling versus pneumatic retinopexy, p 5 .

QUESTION **What are the effects of interventions to treat rhegmatogenous retinal detachment associated with proliferative vitreoretinopathy?**

OPTION **DIFFERENT SUBSTANCES FOR TAMPONADE**

- For GRADE evaluation of interventions for Retinal detachment, see table, p 35 .
- In people undergoing vitrectomy for rhegmatogenous retinal detachment (RRD) with severe proliferative vitreoretinopathy (occurring as a complication of retinal detachment or previous treatment for retinal detachment), silicone oil and long-acting gas are equally effective for increasing re-attachment rates and improving visual acuity; silicone oil is better than short-acting gas.
- Silicone oil may cause less hypotony compared with long-acting gas, especially in people with severe anterior proliferative vitreoretinopathy.

Benefits and harms

Silicone oil tamponade versus long-acting gas tamponade:

We found one systematic review (search date 2009), [48] which identified one RCT [49] comparing silicone oil tamponade versus long-acting gas (C_3F_8, perfluoropropane) in people with severe proliferative vitreoretinopathy (PVR) receiving vitrectomy. The RCT compared treatments in two distinct groups: 131 eyes undergoing initial vitrectomy and 134 eyes undergoing a second vitrectomy after previous failed vitrectomy surgery. [49] We also identified two further reports of the RCT identified by the review, which reported on only adverse effects. [50] [51]

Re-attachment rate

Silicone oil tamponade compared with long-acting gas tamponade Silicone oil tamponade and long-acting gas tamponade seem equally effective at increasing re-attachment rates in people with severe proliferative vitreoretinopathy undergoing initial or repeat vitrectomy for rhegmatogenous retinal detachment (moderate-quality evidence).

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Re-attachment rate					
[49] RCT	131 eyes undergoing initial vitrectomy for rhegmatogenous retinal detachment (RRD) with severe proliferative vitreoretinopathy (PVR) In review [48]	**Re-attachment , last follow-up examination (up to 36 months)** 38/59 (64%) with silicone oil 45/62 (73%) with C_3F_8 Last observation carried forward (LOCF) analysis. See further information on studies for details of follow-up at different time frames	P = 0.33	⟷	Not significant
[49] RCT	134 eyes undergoing a second vitrectomy after previous failed vitrectomy surgery In review [48]	**Re-attachment , last follow-up examination (up to 36 months)** 37/61 (61%) with silicone oil 50/68 (74%) with C_3F_8	Significance not assessed		

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
		LOCF analysis. See further information on studies for details of follow-up at different time frames			

Visual acuity

Silicone oil tamponade compared with long-acting gas tamponade Silicone oil tamponade and long-acting gas tamponade seem equally effective at improving visual acuity in people with severe proliferative vitreoretinopathy undergoing initial or repeat vitrectomy for rhegmatogenous retinal detachment (high-quality evidence).

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Visual acuity					
[49] RCT	131 eyes undergoing initial vitrectomy for rhegmatogenous retinal detachment (RRD) with severe proliferative vitreoretinopathy (PVR) In review [48]	**Proportion who achieved a visual acuity of 5/200 or better , last follow-up examination (up to 36 months)** 29/64 (45%) with silicone oil 29/67 (43%) with C_3F_8 Last observation carried forward (LOCF) analysis. See further information on studies for details of follow-up at different time frames	P = 0.82	⟷	Not significant
[49] RCT	134 eyes undergoing a second vitrectomy after previous failed vitrectomy surgery In review [48]	**Proportion who achieved a visual acuity of 5/200 or better , last follow-up examination (up to 36 months)** 21/63 (33%) with silicone oil 27/71 (38%) with C_3F_8 LOCF analysis. See further information on studies for details of follow-up at different time frames	P = 0.57	⟷	Not significant

Re-operation rate

No data from the following reference on this outcome. [49]

Adverse effects

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Adverse effects					
[49] RCT	265 eyes undergoing initial or repeat vitrectomy for rhegmatogenous retinal detachment (RRD) with severe proliferative vitreoretinopathy (PVR) In review [48]	**Keratopathy , last follow-up examination (up to 36 months)** 30% with silicone oil 33% with C_3F_8 Absolute numbers not reported Last observation carried forward (LOCF) analysis. See further information on studies for details of follow-up at different time frames	P = 0.70	⟷	Not significant

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
[50] RCT	245 eyes undergoing initial or repeat vitrectomy for RRD with severe PVR. Further report of reference [49]	**Elevated intraocular pressure (raised intraocular pressure to >25 mmHg on 2 or more consecutive visits) , 6 months**. 9/120 (8%) eyes with silicone oil. 2/121 (2%) eyes with C_3F_8	P <0.05	○○○	C_3F_8
[50] RCT	245 eyes undergoing initial or repeat vitrectomy for RRD with severe PVR. Further report of reference [49]	**Chronic hypotony (intraocular pressure <5 mmHg on 2 or more consecutive or 3 visits) , 6 months**. 21/120 (18%) eyes with silicone oil. 37/121 (31%) eyes with C_3F_8	P <0.05	○○○	silicone oil
[51] RCT	245 eyes undergoing initial or repeat vitrectomy for RRD with severe PVR. Further report of reference [49]	**Macular pucker , 6 months**. 12% with silicone oil. 19% with C_3F_8. Absolute numbers not reported	P = 0.15	⟷	Not significant

Silicone oil tamponade versus short-acting gas tamponade:

We found one systematic review (search date 2009), [48] which identified one RCT comparing silicone oil tamponade versus short-acting gas (SF_6, sulphur hexafluoride) in people with severe proliferative vitreoretinopathy (PVR) without previous vitrectomy receiving vitrectomy. [52]

Re-attachment rate

Silicone oil tamponade compared with short-acting gas tamponade Silicone oil tamponade seems more effective at increasing re-attachment rates at 6 months in people with severe proliferative vitreoretinopathy undergoing initial vitrectomy for rhegmatogenous retinal detachment (moderate-quality evidence).

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Re-attachment rate					
[52] RCT	101 eyes undergoing initial vitrectomy for rhegmatogenous retinal detachment (RRD) with severe proliferative vitreoretinopathy (PVR). In review [48]	**Re-attachment , 6 months**. 31/51 (61%) with silicone oil. 23/46 (50%) with SF_6. See further information on studies for rate of eyes with subtotal retinal attachment but subsequent successful macular attachment	P <0.05	○○○	silicone oil

Visual acuity

Silicone oil tamponade compared with short-acting gas tamponade Silicone oil tamponade seems more effective at improving visual acuity at 6 months in people with severe proliferative vitreoretinopathy undergoing vitrectomy for rhegmatogenous retinal detachment (moderate-quality evidence).

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Visual acuity					
[52] RCT	101 eyes undergoing initial vitrectomy for rhegmatogenous retinal detach-	**Proportion of eyes with 5/200 or better on the Snellen scale , 6 months**. 31/51 (61%) with silicone oil	P <0.05	○○○	silicone oil

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
	ment (RRD) with severe proliferative vitreoretinopathy (PVR) In review [48]	15/46 (33%) with SF_6			

Re-operation rate

No data from the following reference on this outcome. [52]

Adverse effects

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Adverse effects					
[52] RCT	101 eyes undergoing initial vitrectomy for rhegmatogenous retinal detachment (RRD) with severe proliferative vitreoretinopathy (PVR) In review [48]	**Keratopathy** 10/47 (21%) with silicone oil 19/40 (48%) with SF_6 See further information on studies for rate of keratopathy in eyes with detached macula	P = 0.01	○○○	silicone oil
[52] RCT	101 eyes undergoing initial vitrectomy for RRD with severe PVR In review [48]	**Hypotony , 24 months** 5/47 (11%) with silicone oil 7/40 (18%) with SF_6 See further information on studies for rate of hypotony in eyes with detached macula	P = 0.35	⟷	Not significant

Further information on studies

[49] The RCT aimed to follow people up for 36 months. Data were available for 100% of eyes at 3 months, 91% to 95% of eyes at 12 months, 64% to 73% of eyes at 24 months, and 49% to 53% of eyes at 36 months.

[52] The RCT found that silicone oil significantly increased the proportion of eyes with subtotal retinal attachment but successful macular attachment at 6 months postoperatively compared with SF_6 (10/51 [20%] with silicone oil *v* 5/46 [11%] with SF_6; P <0.05). Rates of both hypotony and keratopathy were higher in eyes with detached macula, although differences between groups were not significant (reported as not significant; P value not reported).

Comment:

Clinical guide:
In people with rhegmatogenous retinal detachment and advanced proliferative vitreoretinopathy (PVR), the PVR-associated membranes can sometimes prevent closure of retinal breaks when using either scleral buckling surgery or pneumatic retinopexy. In this situation, vitrectomy surgery may be indicated to allow the surgical removal of these membranes, and hence allow retinal reattachment. Tamponade of retinal breaks postoperatively can be achieved with long-acting gas or silicone oil. There does not seem to be any major difference in clinical outcome between the two

agents, and the choice of tamponade agent can be individualised for each patient. The advantages of silicone oil include its transparency, which allows some vision when walking immediately after surgery. Silicone oil also facilitates postoperative laser photocoagulation, which is more difficult through a gas bubble. Being non-dissolvable, silicone oil also provides long-term tamponade over a large area of the retina. Disadvantages include the need to remove the oil at a second operation to avoid complications. Oil can be left *in situ* to provide continuous retinal tamponade and avoid retinal detachment, but this carries the risk of long-term complications. Leaving oil *in situ* may be necessary in conditions such as: CMV-associated retinal detachment with multiple atrophic breaks in areas previously affected by retinitis; cases with persistent unrelieved retinal traction; or cases at high risk of hypotony after oil removal.

OPTION CORTICOSTEROIDS DURING VITRECTOMY SURGERY FOR PROLIFERATIVE VITREORETINOPATHY

- For GRADE evaluation of interventions for Retinal detachment, see table, p 35 .
- We found insufficient evidence assessing the effects of corticosteroids given during vitrectomy surgery for proliferative vitreoretinopathy.

Benefits and harms

Corticosteroids versus no corticosteroids/placebo/standard care:

We found one RCT comparing adjunctive triamcinolone acetonide 4 mg after vitrectomy with silicone oil tamponade versus no adjunctive treatment. [53]

Re-attachment rate

Adding intravitreal triamcinolone acetonide to the vitreous cavity compared with no corticosteroid Adding intravitreal triamcinolone acetonide to the vitreous cavity (direct injection into silicone oil) at the completion of vitrectomy surgery seems no more effective at improving retinal re-attachment rates (after 1 operation and final rate) at 6 months in people with rhegmatogenous retinal detachment and grade C proliferative vitreoretinopathy (moderate-quality evidence).

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Re-attachment rate					
[53] RCT	75 people; 75 eyes with rhegmatogenous retinal detachment (RRD) and grade C proliferative vitreoretinopathy (PVR)	**Retinal re-attachment rate after one operation , 6 months** 32/38 (84%) with triamcinolone acetonide 4 mg 29/37 (78%) with no triamcinolone acetonide Triamcinolone acetonide was injected into the silicone-filled vitreous cavity on completion of surgery	P = 0.5	⟷	Not significant
[53] RCT	75 people; 75 eyes with RRD and grade C PVR	**Final retinal re-attachment rate (with or without re-operation) , 6 months** 35/38 (92.1%) with triamcinolone acetonide 4 mg 34/37 (91.9%) with no triamcinolone acetonide Triamcinolone acetonide was injected into the silicone-filled vitreous cavity on completion of surgery	P = 0.97	⟷	Not significant

Visual acuity

Intravitreal triamcinolone acetonide compared with no corticosteroid Adding intravitreal triamcinolone acetonide to the vitreous cavity (direct injection into silicone oil) at the completion of vitrectomy surgery seems no more effective at improving visual acuity at 6 months in people with grade C proliferative vitreoretinopathy (moderate-quality evidence).

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Visual acuity					
[53] RCT	75 people; 75 eyes with rhegmatogenous retinal detachment (RRD) and grade C proliferative vitreoretinopathy (PCR)	**Mean best corrected visual acuity (logMAR units)** 1.2 with triamcinolone acetonide 4 mg 1.4 with no triamcinolone acetonide Triamcinolone acetonide was injected into the silicone-filled vitreous cavity on completion of surgery	P = 0.21	⟷	Not significant

Re-operation rate

No data from the following reference on this outcome. [53]

Adverse effects

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Adverse effects					
[53] RCT	75 people; 75 eyes with rhegmatogenous retinal detachment (RRD) and grade C proliferative vitreoretinopathy (PVR)	**Intraocular pressure , 6 months** 14.7 mmHg with triamcinolone acetonide 4 mg 16.4 mmHg with no triamcinolone acetonide Triamcinolone acetonide was injected into the silicone-filled vitreous cavity on completion of surgery	P = 0.25	⟷	Not significant
[53] RCT	75 people; 75 eyes with RRD and grade C PVR	**Recurrence of PVR , 6 months** 11/38 (29%) with triamcinolone acetonide 4 mg 11/37 (37%) with no triamcinolone acetonide Triamcinolone acetonide was injected into the silicone-filled vitreous cavity on completion of surgery	P = 0.94	⟷	Not significant
[53] RCT	75 people; 75 eyes with RRD and grade C PVR	**Macular pucker , 6 months** 8/38 (21%) with triamcinolone acetonide 4 mg 13/37 (35%) with no triamcinolone acetonide Triamcinolone acetonide was injected into the silicone-filled vitreous cavity on completion of surgery	P = 0.2	⟷	Not significant

Further information on studies

Comment: **Clinical guide:**
The antiproliferative and anti-inflammatory properties of corticosteroids are thought to promote repair in rhegmatogenous retinal detachment (RRD). Topical corticosteroids are routinely given by most surgeons post-surgery to correct RRD, and some surgeons give periocular and systemic corticosteroids in cases of RRD with proliferative vitreoretinopathy (PVR). Triamcinolone acetate is a slow-release corticosteroid preparation, and injection into the vitreous cavity provides a locally higher corticosteroid concentration than can be achieved by systemic or topical administration. Although the small RCT reported here found no benefit associated with using corticosteroids in eyes with RRD and established PVR, [53] corticosteroids may still have a role in other conditions, such as in eyes with inflammation, or after trauma or previous surgery.

OPTION DAUNORUBICIN DURING VITRECTOMY SURGERY FOR PROLIFERATIVE VITREORETINOPATHY

- For GRADE evaluation of interventions for Retinal detachment, see table, p 35 .
- We found insufficient evidence assessing the effects of daunorubicin given during vitrectomy surgery for proliferative vitreoretinopathy.

Benefits and harms

Daunorubicin versus no daunorubicin/placebo/standard care:

We found two RCTs comparing the use of daunorubicin intraoperatively during vitrectomy surgery for rhegmatogenous retinal detachment (RRD) and proliferative vitreoretinopathy (PVR) versus no adjunctive treatment. [54] [55]

Re-attachment rate

Daunorubicin compared with no daunorubicin Infusing daunorubicin intravitreally for 10 minutes during vitrectomy surgery seems no more effective at improving retinal re-attachment rate (after 1 operation) at 3 to 6 months in patients with rhegmatogenous retinal detachment and grade C and D proliferative vitreoretinopathy (moderate-quality evidence).

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Re-attachment rate					
[54] RCT	286 people; 286 eyes with rhegmatogenous retinal detachment (RRD) and proliferative vitreoretinopathy (PVR) of grade C2 or more; multicentre RCT; 24 surgeons	**Retinal re-attachment rate (after 1 operation) , 6 months** 89/142 (63%) with daunorubicin 73/135 (54%) with no daunorubicin See further information on studies for details on daunorubicin injections	OR 1.43 95% CI 0.88 to 2.30 P = 0.07	⟷	Not significant
[54] RCT	286 people; 286 eyes with RRD and PVR of grade C2 or more; multicentre RCT; 24 surgeons	**Overall re-attachment rate (with or without re-operation) , 1 year** 105/131 (80%) with daunorubicin 103/126 (82%) with no daunorubicin See further information on studies for details on daunorubicin injections	Reported as not significant P value not reported	⟷	Not significant
[55] RCT	30 people; 30 eyes with RRD and grade D1 PVR or more	**Retinal re-attachment , 3 months** 13/15 (87%) with daunorubicin 10/15 (67%) with no daunorubicin See further information on studies for details on daunorubicin injections	Reported as not significant P value not reported	⟷	Not significant

Visual acuity

Daunorubicin compared with no daunorubicin Infusing daunorubicin intravitreally for 10 minutes during vitrectomy surgery seems no more effective at improving visual acuity at 3 to 6 months in people with RRD and grade C and D proliferative vitreoretinopathy (moderate-quality evidence).

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Visual acuity					
[54] RCT	286 people; 286 eyes with rhegmatogenous retinal detachment (RRD) and proliferative vitreoretinopathy (PVR) of grade C2 or more; multicentre RCT; 24 surgeons	**Proportion of people with visual acuity rated as improved , 6 months** 113/136 (83%) with daunorubicin 98/128 (77%) with no daunorubicin Improved visual acuity defined as positive difference between preoperative logMAR score and score at 6 months See further information on studies for details on daunorubicin injections	P = 0.17 for between-group comparison (combined analysis of improved, unchanged, and deteriorated)	⟷	Not significant
[54] RCT	286 people; 286 eyes with RRD and PVR of grade C2 or more; multicentre RCT; 24 surgeons	**Proportion of people with visual acuity rated as unchanged , 6 months** 17/136 (13%) with daunorubicin 25/128 (20%) with no daunorubicin Unchanged visual acuity defined as no difference between preoperative logMAR score and score at 6 months See further information on studies for details on daunorubicin injections	P = 0.17 for between-group comparison (combined analysis of improved, unchanged, and deteriorated)	⟷	Not significant
[54] RCT	286 people; 286 eyes with RRD and PVR of grade C2 or more; multicentre RCT; 24 surgeons	**Proportion of people with visual acuity rated as deteriorated , 6 months** 6/136 (4.4%) with daunorubicin 5/128 (3.9%) with no daunorubicin Deteriorated visual acuity defined as negative difference between preoperative logMAR score and score at 6 months See further information on studies for details on daunorubicin injections	P = 0.17 for between-group comparison (combined analysis of improved, unchanged, and deteriorated)	⟷	Not significant
[55] RCT	30 people; 30 eyes with RRD and grade D1 PVR or more	**Proportion of people with improvement in visual acuity , 3 months** 14/15 (93%) with daunorubicin 12/15 (80%) with no daunorubicin See further information on studies for details on daunorubicin injections	Reported as not significant P value not reported	⟷	Not significant

Re-operation rate

Daunorubicin compared with no daunorubicin Infusing daunorubicin intravitreally for 10 minutes during vitrectomy surgery is more effective at reducing the requirement for further vitreoretinal surgery at 1 year in people with rhegmatogenous retinal detachment (RRD) and grade C2 proliferative vitreoretinopathy (high-quality evidence).

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Re-operation rate					
[54] RCT	286 people; 286 eyes with rhegmatogenous retinal detachment (RRD) and proliferative vitreoretinopathy (PVR) of grade C2 or more; multicentre RCT; 24 surgeons	**Proportion of people requiring further vitreoretinal surgery after initial surgery , 1 year** 50/145 (34%) with daunorubicin 65/141 (46%) with no daunorubicin See further information on studies for details on daunorubicin injections	P = 0.005	○○○	Daunorubicin

No data from the following reference on this outcome. [55]

Adverse effects

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Adverse effects					
[54] RCT	286 people; 286 eyes with rhegmatogenous retinal detachment (RRD) and proliferative vitreoretinopathy (PVR) of grade C2 or more; multicentre RCT; 24 surgeons	**Adverse effects** with daunorubicin with no daunorubicin The RCT gave no information on adverse effects associated with daunorubicin The authors reported no treatment-related adverse effects with daunorubicin, and reported no data on other possible adverse effects associated with its use See further information on studies for details on daunorubicin injections			
[55] RCT	30 people; 30 eyes with RRD and grade D1 PVR or more	**Adverse effects** with daunorubicin with no daunorubicin The RCT gave no information on adverse effects associated with daunorubicin The authors reported no treatment-related adverse effects with daunorubicin, and reported no data on other possible adverse effects associated with its use See further information on studies for details on daunorubicin injections			

Further information on studies

[54] If the surgeon determined that the retina could be successfully re-attached, the vitreous cavity was perfused with daunorubicin (7.5 micrograms/mL in balanced saline solution) for 10 minutes. Before silicone oil exchange, daunorubicin was exchanged with balanced saline, perfluorocarbon liquid, or air.

[55] Daunorubicin (5 micrograms in 0.1 mL balanced saline solution) was injected into the vitreous cavity and left for 10 minutes, after which time it was flushed out of the vitreous cavity and silicone oil exchange was carried out.

Comment: **Clinical guide:**
Daunorubicin acts by inhibiting both cell proliferation and cell migration. It can be infused into the vitreous cavity for short periods during vitrectomy surgery without apparent adverse effects. However, it is unclear whether use of daunorubicin as an adjunctive treatment confers benefits in eyes with rhegmatogenous retinal detachment and established proliferative vitreoretinopathy.

OPTION FLUOROURACIL PLUS HEPARIN DURING VITRECTOMY SURGERY FOR PROLIFERATIVE VITREORETINOPATHY

- For GRADE evaluation of interventions for Retinal detachment, see table, p 35 .
- We found insufficient evidence assessing the effects of fluorouracil plus heparin given during vitrectomy surgery for proliferative vitreoretinopathy.

Benefits and harms

Fluorouracil plus heparin versus placebo:

We found one RCT comparing adding perioperative fluorouracil plus low molecular weight heparin to the intraocular infusion versus adding placebo to the intraocular infusion in people having vitrectomy with silicone oil tamponade. [56]

Re-attachment rate

Fluorouracil plus low molecular weight heparin compared with placebo Adding fluorouracil plus low molecular weight heparin to the intraocular infusion may be no more effective at increasing surgery success rates (re-attaching with removal of silicone oil without further operations and final re-attachment rate) in people with grade C anterior or posterior proliferative vitreoretinopathy (low-quality evidence).

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Re-attachment rate					
[56] RCT	157 people with grade C anterior or posterior proliferative vitreoretinopathy (PVR)	**Proportion of people with successful surgery , 6 months** 39/70 (56%) with fluorouracil plus heparin 40/78 (51%) with placebo Successful surgery defined as re-attachment with removal of silicone oil without further operations	P = 0.589	⟷	Not significant
[56] RCT	157 people with grade C anterior or posterior PVR	**Overall complete retinal re-attachment rate with or without re-operation , 6 months** 56/67 (83.5%) with fluorouracil plus heparin 65/77 (84.4%) with placebo	Reported as not significant P value not reported	⟷	Not significant

Visual acuity

Fluorouracil plus low molecular weight heparin compared with placebo Adding fluorouracil plus low molecular weight heparin to the intraocular infusion seems no more effective at improving visual acuity in people with grade C anterior or posterior proliferative vitreoretinopathy (moderate-quality evidence).

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Visual acuity					
[56] RCT	157 people with grade C anterior or posterior proliferative vitreoretinopathy (PVR)	**Mean visual acuity on logMAR scale** 1.8 with fluorouracil plus heparin 1.4 with placebo	P = 0.126	⟷	Not significant

Re-operation rate

No data from the following reference on this outcome. [56]

Adverse effects

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Adverse effects					
[56] RCT	157 people with grade C anterior or posterior proliferative vitreoretinopathy (PVR)	**Macular pucker , 6 months** 4/66 (6%) with fluorouracil plus heparin 13/77 (17%) with placebo	P = 0.068	⟷	Not significant
[56] RCT	157 people with grade C anterior or posterior PVR	**Glaucoma , 12 months** 0 with fluorouracil plus heparin 3 with placebo Adverse effects data at 12 months available for 98/157 (62%) participants Unclear whether figures represent percentages or absolute number of people with adverse effect in each group	Reported as not significant P value not reported	⟷	Not significant
[56] RCT	157 people with grade C anterior or posterior PVR	**Hypotony , 12 months** 9 with fluorouracil plus heparin 7 with placebo Adverse effects data at 12 months available for 98/157 (62%) participants Unclear whether figures represent percentages or absolute number of people with adverse effect in each group	Reported as not significant P value not reported	⟷	Not significant
[56] RCT	157 people with grade C anterior or posterior PVR	**Keratopathy , 12 months** 5 with fluorouracil plus heparin 2 with placebo Adverse effects data at 12 months available for 98/157 (62%) participants Unclear whether figures represent percentages or absolute number of people with adverse effect in each group	Reported as not significant P value not reported	⟷	Not significant

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
[56] RCT	157 people with grade C anterior or posterior PVR	**Need for cataract extraction , 12 months** 21 with fluorouracil plus heparin 29 with placebo Adverse effects data at 12 months available for 98/157 (62%) participants Unclear whether figures represent percentages or absolute number of people with adverse effect in each group	Reported as not significant P value not reported	⟷	Not significant

Further information on studies

Comment: **Clinical guide:**
Despite evidence suggesting that 5-fluorouracil plus heparin can prevent proliferative vitreoretinopathy (PVR) in people with high-risk features for PVR undergoing vitrectomy surgery for rhegmatogenous retinal detachment, [57] it is unclear whether fluorouracil plus heparin is effective at improving retinal re-attachment rates in people with established PVR. The prevention of PVR will be addressed in full in future updates of this review.

GLOSSARY

Classification of PVR Grade A PVR denotes vitreous haze and pigment clumping (of retinal pigment epithelium cells) in the vitreous cavity (although this grade is rarely used). Grade B PVR shows areas of surface retinal wrinkling with rolled edges to retinal tears. Grade C PVR consists of fixed full thickness retinal folds involving 1 to 3 quadrants: Grade C1–C3. Grade D was classified as a total RRD with either a wide (D1), narrow (D2), or closed (D3) funnel configuration because of fixed retinal folds. [34] Grade D was removed from the 1991 classification update, [35] and Grade C was divided into anterior and posterior PVR, which is then subdivided based on the number of hours involved (CA1–12 and CP1–12), and on type of fibrosis and contracture present (focal, diffuse, or subretinal, and anteriorly, circumferential, and/or anterior displacement [anterior loop traction]).

Aphakic An aphakic eye has neither a natural crystalline lens nor an artificial lens.

Macular pucker refers to the distorted anatomical appearance of the macular retina caused by localised epiretinal fibrotic membrane formation. It can result in distorted and reduced central vision.

Phakic A phakic eye has an intact natural crystalline lens.

Pneumatic retinopexy A small volume of gas, primarily expansile gas, is injected into the vitreous cavity and used to close the retinal break(s). No attempt is made to relieve vitreoretinal traction. Once closure of retinal breaks is achieved, the physiological retinal pigment epithelium pump removes subretinal fluid resulting in retinal reattachment. Before or after gas injection, laser or cryotherapy is usually applied to the retinal breaks (retinopexy) to create a permanent choroidoretinal adhesion.

Proliferative vitreoretinopathy (PVR) after a retinal detachment may occur either spontaneously before surgery or after treatment. PVR refers to the growth of avascular fibrocellular membranes within the vitreous cavity and on the front and back surfaces of the retina. These membranes, which are essentially scar tissues, occur in the mildest form as fine fibrous membranes on the retinal surface without visible retinal distortion or merely rolling of the edges of retinal breaks. In more severe forms, the membranes cause fixed retinal folds, preventing closure of retinal breaks and exerting traction on the retina. Retinal folds may also result in recurrence of retinal detachment, even after an initially successful retinal detachment procedure, because of spontaneous reopening of otherwise successfully treated retinal breaks, or because of the development of new retinal breaks. Epiretinal membranes on the surface of the macula causing macular pucker and ocular hypotony secondary to PVR involving the ciliary body may also occur. PVR may result in disappointing visual results. [59]

Pseudophakic A pseudophakic eye has had the natural lens removed and replaced with an artificial intraocular lens implant.

Retinal dialysis is a separation of the retina where it inserts into the pars plana at the ora serrata.

Retinal operculum This is a separated flap of retina avulsed from the retinal surface by vitreoretinal separation, leaving a retinal hole.

Retinal-flap tear This is a tear in the retina associated with local vitreoretinal traction, separation, or both; the flap of the tear remains attached to the vitreous and connected by its base to the anterior edge of the retinal tear.

Scleral buckling surgery A buckling element or explant, usually made of either solid silicone or silicone sponge, is sutured to the sclera externally to indent the sclera and underlying retinal pigment epithelium towards the detached retina at the site of the retinal break(s), to close the break and relieve vitreoretinal traction. Buckles can be either segmental or encircling. Once closure of retinal breaks is achieved, the physiological retinal pigment epithelium pump removes subretinal fluid resulting in retinal reattachment. This process can be assisted by subretinal fluid drainage at the time of surgery, which also allows break closure if subretinal fluid is deep. During surgery, laser or cryotherapy is usually applied to the retinal breaks (retinopexy) to create a permanent choroidoretinal adhesion. [60]

Silicone oil tamponade is used in vitrectomy as an alternative to gas. Silicone oil is also now available in a heavier-than-water preparation, allowing inferior retinal tamponade without head-down posturing.

logMAR chart A tool for measuring visual acuity, similar to but more precise than a Snellen chart. The chart is typically read at 4 m and scored from the total number of letters read. A score of 1.0 is equivalent to Snellen acuity 6/60 and indicates that all 5 letters on the top line, but no others, were read. A score of 0.1 is equivalent to Snellen acuity 6/6.

Cryotherapy (cryopexy) is the transcleral application of cryotherapy to retinal breaks or predisposing rhegmatogenous retinal detachment lesions using a cryotherapy probe. The head of the probe is positioned on the area of sclera overlying the retinal area to be treated using visual control by means of indirect ophthalmoscopy and indentation of the sclera. Overlapping areas are frozen until the whole lesion is treated creating an area of full-thickness chorioretinal adhesion within 7 to 10 days of treatment application. Cryotherapy can be carried out under local anaesthetic. If the retinal lesions to be treated are located on the posterior retinal surface, the conjunctiva is opened to allow probe placement on the corresponding posterior area of sclera.

High-quality evidence Further research is very unlikely to change our confidence in the estimate of effect.

Laser photocoagulation Refers to the transpupillary application of laser (usually argon laser) to retinal breaks or predisposing rhegmatogenous retinal detachment lesions. It can be delivered either by a slit lamp-mounted laser system or by using a laser connected to an indirect ophthalmoscope. Contiguous laser burns are placed around the lesion in 2 to 3 rows leading to areas of full-thickness chorioretinal adhesion within 2 to 3 days of treatment. Laser photocoagulation can be carried out under local anaesthetic. Because it is delivered through the pupil, posterior retinal lesions can be treated without the need to open the conjunctiva.

Low-quality evidence Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.

Moderate-quality evidence Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.

Posterior vitreous detachment (PVD) is the separation of the vitreous gel from its posterior attachment to the retina. PVD is associated with ageing of the vitreous characterised by liquefaction of the vitreous gel itself. Liquefaction occurs at an earlier age in myopic eyes than in emmetropic and hypermetropic eyes, and can be accelerated by inflammation caused by surgery, trauma, or uveitis. Vitreous liquefaction leads to vitreous gel instability, which triggers PVD. PVD is present in autopsy studies in less than 10% of people aged under 50 years, in at least one eye in 27% of people aged 60 to 65 years, and in 63% of people aged over 70 years. It usually occurs as an acute event with rapid evolution of vitreoretinal separation from the posterior to anterior retina. [58]

Snellen visual acuity The Snellen chart usually includes letters, numbers, or pictures printed in lines of decreasing size, which are read or identified from a fixed distance; distance visual acuity is usually measured from a distance of 6 m (20 feet). The Snellen visual acuity is written as a fraction: 6/18 means that from 6 m away the best line that can be read is a line that could normally be read from a distance of 18 m away.

Stickler's syndrome (hereditary arthro-ophthalmopathy) is a hereditary disease of type 2 collagen resulting in abnormal vitreous, myopia, and a variable degree of orofacial abnormalities, deafness, and arthropathies.

Very low-quality evidence Any estimate of effect is very uncertain.

Visual acuity testing This is carried out with charts using letters or standard pictures or symbols. Modern tests that incorporate crowding and logMAR (logarithm of the minimum angle of resolution) size scaling are more accurate. One line of letters or symbols (usually 4 or 5) constitutes 0.1 logMAR units and roughly approximates to one line on a Snellen chart, although this conversion factor is inaccurate and should only be used as a crude guide to interpretation. Given the variability in test performance within individuals, a change in 0.2 logMAR units is often quoted as being the smallest clinically important change, although some studies use a change of 0.1 logMAR or greater, which might be considered clinically more marginal. Change of less than 0.1 logMAR unit is not clinically important and could be accounted for by test–retest variability.

Vitrectomy The vitreous is removed internally using a cutting aspirating instrument relieving vitreoretinal traction directly. A tamponade agent, usually gas or silicone oil, is used to close the break(s). Closure is assisted by postoperative positioning to place the tamponade bubble against the break(s) in an optimum way. Gases can be short- (SF_6), medium- (C_2F_6), or long-acting (C_3F_8), and last a variable period of time depending on concentration and gas fill before being absorbed. Once closure of retinal breaks is achieved, the physiological retinal pigment epithelium pump removes subretinal fluid resulting in retinal reattachment. This process can be assisted by subretinal fluid drainage at the time of surgery. During surgery, laser or cryotherapy is usually applied to the retinal breaks (retinopexy) to create a permanent choroidoretinal adhesion. [61]

SUBSTANTIVE CHANGES

Different substances for tamponade One systematic review added, [48] which identified two previously reported RCTs comparing silicone oil versus short- and long-acting gas tamponade in people receiving vitrectomy for RRD associated with PVR. No new data added. Categorisation unchanged (Likely to be beneficial).

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Disclaimer

TABLE 1 **Visual acuity scales used in RCTs.**

LogMAR	Snellen (metres)	Snellen (feet)	Snellen (decimal)	
0	6/6	20/20	1	
0.1	6/7.5	20/25	0.8	
0.3	6/12	20/40	0.5	
0.4	6/15	20/50	0.4	
0.6	6/24	20/80	0.25	
1	6/60	20/200	0.1	
1.2	6/96	20/320	0.06	
1.3	6/120	20/400	0.05	
1.6	6/240 (often recorded as 1.5/60)	20/800 (often recorded as 5/200)	0.03	
2	6/600	20/2000	0.01	About equivalent to count fingers vision at 2 feet (sometimes quoted as being equivalent to logMAR 1.85) [62]
3	6/6000	20/20,000	0.001	About equivalent to hand movements vision at 2 feet (sometimes quoted as being equivalent to logMAR 2.3)

GRADE **Evaluation of interventions for Retinal detachment.**

Important outcomes			Re-attachment rate, Re-operation rate, Visual acuity						
Studies (Participants)	Outcome	Comparison	Type of evidence	Quality	Consistency	Directness	Effect size	GRADE	Comment
What are the effects of different surgical interventions in people with rhegmatogenous retinal detachment?									
2 (218) [40] [41]	Re-attachment rate	Scleral buckling versus pneumatic retinopexy	4	–1	0	0	0	Moderate	Quality point deducted for incomplete reporting
2 (218) [40] [41]	Visual acuity	Scleral buckling versus pneumatic retinopexy	4	–1	0	0	0	Moderate	Quality point deducted for incomplete reporting
4 (690) [42] [43] [44] [45]	Re-attachment rate	Scleral buckling versus primary vitrectomy in pseudophakic or aphakic rhegmatogenous retinal detachment (RRD)	4	0	–1	–1	0	Low	Consistency point deducted for conflicting results. Directness point deducted for inclusion of co-intervention (scleral buckling in primary vitrectomy arm)
4 (690) [42] [43] [44] [45]	Visual acuity	Scleral buckling versus primary vitrectomy in pseudophakic or aphakic rhegmatogenous retinal detachment (RRD)	4	0	–1	–1	0	Low	Consistency point deducted for conflicting results. Directness point deducted for inclusion of co-intervention (scleral buckling in primary vitrectomy arm)
1 (150) [42]	Re-operation rate	Scleral buckling versus primary vitrectomy in pseudophakic or aphakic rhegmatogenous retinal detachment (RRD)	4	–1	0	0	0	Moderate	Quality point deducted for sparse data
3 (523) [45] [46] [47]	Re-attachment rate	Scleral buckling versus primary vitrectomy in phakic rhegmatogenous retinal detachment (RRD)	4	–1	0	–2	0	Very low	Quality point deducted for incomplete reporting. Directness points deducted for unclear outcome in one RCT and inclusion of co-intervention in one RCT (scleral buckling in primary vitrectomy arm)
3 (515) [45] [46] [47]	Visual acuity	Scleral buckling versus primary vitrectomy in phakic rhegmatogenous retinal detachment (RRD)	4	0	–1	–1	0	Low	Consistency point deducted for conflicting results. Directness point deducted for inclusion of co-intervention (scleral buckling in primary vitrectomy arm)
What are the effects of interventions to treat rhegmatogenous retinal detachment associated with proliferative vitreoretinopathy?									
1 (265 eyes) [49]	Re-attachment rate	Silicone oil tamponade versus long-acting gas tamponade	4	–1	0	0	0	Moderate	Quality point deducted for methodological issues (no statistical assessment for one comparison and poor follow-up at 36 months)
1 (265 eyes) [49]	Visual acuity	Silicone oil tamponade versus long-acting gas tamponade	4	0	0	0	0	High	
1 (97 eyes) [52]	Re-attachment rate	Silicone oil tamponade versus short-acting gas tamponade	4	–1	0	0	0	Moderate	Quality point deducted for sparse data
1 (97 eyes) [52]	Visual acuity	Silicone oil tamponade versus short-acting gas tamponade	4	–1	0	0	0	Moderate	Quality point deducted for sparse data
1 (75) [53]	Re-attachment rate	Corticosteroids versus no corticosteroids/placebo/standard care	4	–1	0	0	0	Moderate	Quality point deducted for sparse data
1 (75) [53]	Visual acuity	Corticosteroids versus no corticosteroids/placebo/standard care	4	–1	0	0	0	Moderate	Quality point deducted for sparse data

Important outcomes			Re-attachment rate, Re-operation rate, Visual acuity						
Studies (Participants)	Outcome	Comparison	Type of evidence	Quality	Consistency	Directness	Effect size	GRADE	Comment
2 (307) [54] [55]	Re-attachment rate	Daunorubicin versus no daunorubicin/placebo/standard care	4	–1	0	0	0	Moderate	Quality point deducted for incomplete reporting
2 (294) [54] [55]	Visual acuity	Daunorubicin versus no daunorubicin/placebo/standard care	4	–1	0	0	0	Moderate	Quality point deducted for incomplete reporting
1 (286) [54]	Re-operation rate	Daunorubicin versus no daunorubicin/placebo/standard care	4	0	0	0	0	High	
1 (148) [56]	Re-attachment rate	Fluorouracil plus heparin versus placebo	4	–2	0	0	0	Low	Quality points deducted for sparse data and incomplete reporting
1 (157) [56]	Visual acuity	Fluorouracil plus heparin versus placebo	4	–1	0	0	0	Moderate	Quality point deducted for sparse data

We initially allocate 4 points to evidence from RCTs, and 2 points to evidence from observational studies. To attain the final GRADE score for a given comparison, points are deducted or added from this initial score based on preset criteria relating to the categories of quality, directness, consistency, and effect size. Quality: based on issues affecting methodological rigour (e.g., incomplete reporting of results, quasi-randomisation, sparse data [<200 people in the analysis]). Consistency: based on similarity of results across studies. Directness: based on generalisability of population or outcomes. Effect size: based on magnitude of effect as measured by statistics such as relative risk, odds ratio, or hazard ratio.